

Through the kindness of Mr. Milne Home, I have been favoured with the sight of letters addressed to you by four eminent mineralogists, Dana of America, Rammeisberg of Berlin, Szabo of Buda-Pesth, and King of Queen's College, Galway. Szabo states that the notice of your paper on the Feldspars, which appeared in Groth's *Zeitschrift für Mineralogie*, greatly interests him, and makes him desirous of placing himself in direct communication with the author. Dana says, 'I have read your paper on the Feldspars, in the Transactions of the Royal Society of Edinburgh, with great satisfaction. Your thorough method of work leads towards important results of great geological, as well as mineralogical value.'

"I have the satisfaction, in the name of the Council of this Society, of presenting you with the Keith Medal. It is hoped that this recognition of your labours will not be without encouragement to you in the arduous researches in which you are engaged."

OUR ASTRONOMICAL COLUMN

TEMPEL'S COMET, 1867 II.—Now that Brorsen's comet of short period is again under observation, the next comet of the same class to be sought for, is that discovered by Dr. Tempel at Marseilles, on April 3, 1867, which was also observed at its next appearance in 1873; it is probable there may be greater difficulty in recovering this object, than appears to have been the case with Brorsen's comet, the reason for which may be made clearer if we briefly detail its history since the year 1867. Less than a month after it was discovered in that year the deviation of the orbit from a parabola became evident, and several of the German astronomers, Prof. Bruhns, now Director of the Observatory of Leipzig, in the first instance, deduced elliptical orbits, with periods of between five and six years. The most complete investigations on the motion of the comet in this year were due to Dr. Sandberg and Mr. Searle. The comet was observed by Dr. Julius Schmidt at Athens till August 21, and the perihelion passage having taken place on May 23, a considerable arc of the orbit was included within the limits of visibility. Dr. Sandberg, after taking into account the effect of planetary perturbations during the comet's appearance, found the period of revolution 2,080 days. On examining the track of this body with reference to the orbits of the planets, it was seen that near the aphelion it must approach very near to the orbit of Jupiter, the least distance being within 0.37 of the mean distance of the earth from the sun, and from the position of this great planet near the time of aphelion passage of the comet early in 1870, it was obvious that great perturbations in the elements of the latter must ensue, and without at least an approximate knowledge of their amount, there might be difficulty in recovering the comet at its next return to perihelion. The first publication of results in this direction was by Mr. W. E. Plummer, from Mr. Bishop's observatory, Twickenham, in February, 1873, followed shortly afterwards by particulars of similar independent investigations undertaken by Dr. Seeliger, of Leipzig, and the late Dr. von Asten, of Pulkowa. It was found that the effect of the attraction of Jupiter, which planet was only 0.32 distant from the comet on January 20, 1870, caused a retrograde change in the longitude of the node to the amount of $22\frac{1}{2}^{\circ}$, and increased the inclination of the orbital plane to the ecliptic nearly 3° ; the period of revolution was lengthened by more than three months, and the point of nearest approach to the sun was removed further from him by upwards of 0.2 of the earth's mean distance. Changes in the elements to this amount would of course entirely alter the track of the comet in 1873, but they had been so closely determined, that immediately after receiving an ephemeris in which their effect was included, M. Stephan re-detected the comet at Marseilles, and as early as April 3, or five weeks before the perihelion passage,

and it was observed until the last week in June. We subjoin Dr. Sandberg's elements for the two appearances:—

	1867.	1873.
Perihelion passage	May 23 ⁹²⁰⁴ G.M.T.	May 9 ⁰¹³⁴ G.M.T.
Long. of perihelion	236° 9' 24" ...	237° 38' 42" ...
ascending node	101° 10' 10" ...	78° 44' 39" ...
Inclination to ecliptic	6° 24' 36" ...	9° 44' 13" ...
Angle of excentricity	30° 38' 39" ...	27° 30' 58" ...
Log. semi-axis major	0.503658 ...	0.517057 ...
Revolution	2080.1 days ...	2178.6 days ...

The longitudes are reckoned from the mean equinox of the commencement of the respective years. The period of revolution applies to the ellipse which the comet was describing at perihelion passage.

With regard to the length of the actual revolution, it is certain that no very material perturbation can result from known causes: Jupiter, the great disturber of the cometary motions, was at almost his greatest possible distance from the comet when the latter passed nearest to his path about May, 1876. A recent investigation by M. Raoul Gautier, of which, however, no details are yet published, assigns a longer period of revolution corresponding to the perihelion passage in 1873 than was given by Dr. Sandberg, the difference being about 10½ days, so that if the mean motion at the last appearance does not, as M. Gautier implies, admit of exact determination, there will be an uncertainty in the date of the approaching perihelion passage, which will necessitate a pretty extended and careful search in order to detect the comet. It belongs to the fainter class, and although in 1867 and 1873 it appeared under rather favourable circumstances for observation, and is likely to do so to a certain extent this year, it has never been a good telescopic object. When at its greatest intensity of light early in May, 1867, its nucleus, which was stellar, had not the brightness of a star of the ninth magnitude. At the last observation at Athens, in that year the theoretical intensity of light was 0.21, and the comet would have the same degree of brightness about March 27 next, whether we assume the time of perihelion passage (perturbation neglected) from the orbit of Dr. Sandberg or M. Gautier, but the uncertainty of position may probably delay its rediscovery till some time later. We may hope that the publication of the further results of M. Gautier, who mentions being engaged on the calculation of perturbations during the present revolution, will not be long deferred. It is desirable the comet should be under observation as long as practicable at this return, since the period being now nearly equal to half that of Jupiter, the two bodies will come into proximity again towards the month of November, 1881, though their mutual distance may not be less than 0.55. This will involve a new, strict investigation similar to those undertaken in 1873, to enable the epoch of ensuing perihelion passage to be ascertained.

Using Dr. Sandberg's orbit of 1873, the comet's place at Greenwich midnight, on March 27, would be in R.A. $253^{\circ}9$, N.P.D. $103^{\circ}7$, or, if the perihelion passage be assumed ten days later, which would more nearly accord with M. Gautier's calculation in R.A. $247^{\circ}0$, N.P.D. $101^{\circ}0$.

THE INTRA-MERCURIAL PLANET QUESTION.—It appears that this subject has lately engaged the attention of that excellent practical astronomer Dr. Oppölzer, of Vienna, who has communicated to the *Astronomische Nachrichten* some curious results of his examination of the records of rapidly-moving dark spots upon the sun's disk. His inquiry resolves itself simply into the conclusion, that even introducing rather more extended data than were used by Leverrier, who, it will be remembered, found several possible periods of revolution for the hypothetical planet, they may all be represented so far as regards the necessity of a transit across the sun's disk on

the days named, by an orbit, the elements of which Dr. Oppölzer gives as follows :—

Epoch 1850, January 1^o, Paris M. T.

Mean anomaly	356 0	
Longitude of perihelion	27 45	} Equinox of 1850.
" " ascending node	178 0	
Inclination to ecliptic	7 0	
Angle of excentricity	14 13	or $e = 0.2456$
Log. semi-axis major	9.0906	
Mean diurnal motion	22.789529	

The period of revolution would therefore be 15.797 days. Comparing with the observations employed the following are the differences shown by the above orbit in geocentric longitude; the calculated geocentric latitude is annexed :—

	Diff. longitude.	Latitude.
1800, March 29, Fritsch	+ 0.6	+ 14
1802, Oct. 10, "	+ 0.4	- 14
1819, Oct. 9, Stark	+ 0.2	- 13
1839, Oct. 2, Decupis	+ 0.5	- 7
1849, March 12, Sidebotham	- 0.8	- 7
1857, Sept. 12, Ohrt	+ 0.1	+ 7
1859, March 26, Lescarbault	0.0	+ 10
1862, March 20, Lummis	+ 0.1	+ 2

But it is unfortunate that notwithstanding this almost perfect representation of the longitudes assumed and the circumstance that the latitudes point to a transit across the sun's disk on every date, there are apparently fatal objections to our admitting the existence of a planet with these elements, several of which are pointed out by Dr. Oppölzer. It may be sufficient to mention here the first of them :—With so short a period and small inclination, a transit across the sun's disk would occur every year, and we know that observation by no means supports such a condition. However, the existence of a body moving in this orbit will admit, as Dr. Oppölzer states, of very early decision :—On March 18 a nearly central transit should occur—

Ingress at 18 8 Berlin M. T. ...	Angle of position 74
Egress at 23 15 " ...	" 254

We give these particulars as affording another illustration of the difficulties attending any trustworthy inferences from the observations of suspicious spots upon the sun's disk. The above orbit, it should be mentioned, will not accord with either of Prof. Watson's presumed planets, though possibly, by increasing the excentricity, elements might be found which would agree with one or other of his positions, while representing most of the observations used by Dr. Oppölzer. We ignore the idea of a want of *bona fides* on the part of the observers on so many occasions, but there is still to be remembered the fact that comets have traversed the sun's disk, and with small perihelion distances might do so without our discovering them except in the course of transit, supposing them to possess the degree of condensation which some have indicated. The object observed by M. Coumbary at Constantinople in May, 1865, could only have been a comet, with a perihelion distance so small as, like the great comet of 1843, almost to graze the sun's surface.

GEOGRAPHICAL NOTES

AT the meeting of the Geographical Society on Monday, when the Earl of Dufferin occupied the presidential chair for the second and last time, Mr. T. J. Comber, of the Baptist Missionary Society, who is about to lead an expedition above the Yellala Falls of the Congo, gave some account of his explorations inland from Mount Cameroons, in the course of which he visited a district of country previously unknown, and discovered a small lake to the northward of the mountain; he also ascertained that there was a broad valley there instead of a continuous

mountain range. He mentioned one fact with regard to Mount Cameroons, which goes far to show that there may be some difficulty in finding a suitable spot for the proposed missionary sanatorium. When at an elevation of 2,000 feet there were such heavy mists, that, although he slept between two fires, his blanket was wet through. It is, of course, possible that here, as in the Neilgherry Hills, and other places, positions may be found to which the miasmatic influences do not extend. Mr. Comber next gave some brief and interesting notes of a journey which he made through Congo to Makuta, the place which Lieut. Grandy saw from the brow of a neighbouring hill, but was not allowed to enter. Sir Henry Barkly afterwards read some observations on the Bamangwata country in South Africa, to which a melancholy interest attached from the fact of their having been drawn up by the late Capt. R. R. Patterson, who recently met with his death by poison when some three days' journey from the Victoria Falls of the Zambesi. The country would appear to be of a not very promising nature, for its soil is sand, covered with stunted bush, and there are few mountain fastnesses, except those near Shoshong, the capital; in the winter it is badly watered, as the Limpopo, Zambesi, and Zouga (or lake river), are the only rivers which run continuously, while the Tati, Shasha, and Makalapogo, are sand rivers. The open country is sparsely inhabited by Veld-people of two classes, the Bakala and Masarwa, of whom the former enjoy the right of possessing cattle and gardens, but the latter neither; they are, in fact, slaves, living on game and roots. The Bamangwata country is ruled by a chief named Khame, whom Capt. Patterson described as a very good man, an opinion in which Sir H. Barkly concurred.

IN connection with the meeting on Monday at Preston in reference to a Central African railway, the letter in yesterday's *Times* from the Alexandria correspondent of that paper is of interest. It seems that the Khedive had some time ago devised an excellent scheme for bringing the riches of the great lake district to the outer world by way of the Indian Ocean, at the mouth of the Juba river. The distance between that point and Victoria Nyanza is only 280 miles, and McKillop Pasha was instructed to work gradually from the coast, planting colonial stations at regular distances, while Gordon Pasha was to co-operate from the lake side. Though the plan seems to have been ably, but too secretly devised by the Khedive, it rather unfortunately fell through, we think on account of the jealousy of the Sultan of Zanzibar and his friends. There is no talk by the Khedive of a railway, and we think with the *Times* correspondent, that something more elementary should be attempted, with a country so totally undeveloped as that of Africa. That it will be opened to trade soon by some nation is evident. English, Germans, Italians, French, Portuguese, are all striving from various points. There is plenty of room for all.

A LARGE amount of material for arriving at some approximately correct notion of the mean depth of the sea, has accumulated in recent years. In a note to the Göttingen Academy, Dr. Krümmel has lately attempted this, in view of the vague and variable statements on the subject in text-books. Soundings were wanting for the Antarctic and a part of the North Polar Sea, *i.e.*, about 475,000 square miles, or 7 per cent. of the entire sea-surface, so that he gives his estimate only as a closer approximation. He estimates, then, the mean depth of the sea as 1,877 fathoms, or 3,432 metres, or 0.4624 geographical miles. It was natural to compare the mean height of dry land above the sea-level. Humboldt's estimate of 308 metres is regarded as quite out of date. Leipoldt has since estimated the mean height of Europe as 300 metres. Accepting this number for Europe, 500 for Asia and Africa, 330 for America, and 250 for